

Listing of Claims:

1. (currently amended) A computer implemented method for determining positional relationships among objects represented in a database, the method comprising:

receiving a query including at least a first object and a desired relationship between the first object and a second object;

defining a plurality of tiles in a spatial index in the database;

identifying, for the first object, tiles in the plurality of tiles that do not intersect an object and are within the boundaries of the first object while all of a boundary of the first object lies outside the tiles and by identifying tiles in the plurality of tiles that intersect a boundary of the first object;

identifying, for the second object, tiles in the plurality of tiles that intersect and are within the boundaries of the second object and tiles in the plurality of tiles that intersect a boundary of the second object;

providing the query to a primary filter operable to:

comparing tiles of a the first object with tiles of a the second object to determine whether at least one tile of the first object intersects with at least one tile of the second object; and

determining whether the at least one tile of the second object with which the at least one tile of the first object intersects is a tile that intersects the second object while all of the boundary of the second object lies outside the tile;

if so, providing the first object to the results set of objects that satisfy the desired relationship,

otherwise, providing the first object and the second object to a secondary filter operable to:

compare the second object with the first object; and
if the first object fulfills the positional relationship, including the first object in the result set of objects that satisfy the desired relationship.

2. (canceled)

3. (canceled)

4. (previously presented) The method according to claim 1, wherein a positional relationship among objects includes at least one member selected from the group comprising:

a first object in a second object,

a second object contained by a first object,

a first object in a second object where a boundary of the first object intersects a boundary of the second object,

a first object covering a second object where a boundary of the first object intersects a boundary of the second object,

a first object outside a second object where a boundary of the first object intersects a boundary of the second object,

a first object does not cover a second object where a boundary of the first object intersects a boundary of the second object,

a first object overlaps a second object but the boundaries of the first object and the second object do not touch,

a first object overlaps a second object and the boundaries of the first object and the second object touch,

a first object is equivalent to a second object, and

a first object is disjoint from a second object.

5. (canceled)

6. (canceled)

7. (original) The method according to claim 1, wherein the tiles all have at least one of the same size and the same shape.

8. (original) The method according to claim 7, wherein the tiles are rectangular.

9. (original) The method according to claim 1, wherein the tiles have different sizes.

10. (previously presented) The method according to claim 1, wherein the database comprises objects on a surface or in a three-dimensional space.

11. (previously presented) The method according to claim 10, wherein the database stores exact representations of the objects and approximate representations of the objects.

12. (previously presented) The method according to claim 1, wherein the objects comprise polygons and the method determines positional relationships among polygons.

13. (previously presented) The method according to claim 11, wherein the objects comprise linestrings and polygons and the method determines positional relationships among the polygons.

14. (original) The method according to claim 13, wherein the linestrings represent streets and the polygons represent a geographic region, and the method determines streets that at least partially fall within the geographic region.

15. (original) The method according to claim 14, wherein the geographic region includes a member selected from the group comprising counties, cities, and zip code regions.

16. (canceled)

17. (previously presented) The method according to claim 1, wherein the objects are organized with a linear quadtree index.

18. (previously presented) The method according to claim 1, wherein the step of determining whether the at least one tile of the second object with which the at least one tile of the first object intersects is an interior tile of the second object is applied only to objects wherein at least one tile of the first object intersects with at least one tile of the a second object.

19. (previously presented) The method according to claim 1, further comprising:

assigning each tile, a tile code and an associated object as the tiles are defined.

20. (currently amended) A computer program product for performing a process for determining positional relationships among objects represented in a database in a computer system, comprising:

a computer readable medium; and

computer program instructions, recorded on the computer readable medium, executable by a processor, for performing the steps of

receiving a query including at least a first object and a desired relationship between the first object and a second object;

defining a plurality of tiles in a spatial index in the database;

identifying, for the first object, tiles in the plurality of tiles that do not intersect an object and are within the boundaries of the first object while all of a boundary of the first object lies outside the tiles and by identifying tiles in the plurality of tiles that intersect a boundary of the first object;

identifying, for the second object, tiles in the plurality of tiles that intersect and are within the boundaries of the second object and tiles in the plurality of tiles that intersect a boundary of the second object;

providing the query to a primary filter operable to:

comparing tiles of a the first object with tiles of a the second object to determine whether at least one tile of the first object intersects with at least one tile of the second object; and

determining whether the at least one tile of the second object with which the at least one tile of the first object intersects is a tile that intersects the second object while all of the boundary of the second object lies outside the tile;

if so, providing the first object to the results set of objects that satisfy the desired relationship,

otherwise, providing the first object and the second object to a secondary filter operable to:

compare the second object with the first object; and
if the first object fulfills the positional relationship, including the first object in the result set of objects that satisfy the desired relationship

21. (currently amended) A system for performing a process method for determining positional relationships among objects represented in a database, comprising:

a processor operable to execute computer program instructions; and

a memory operable to store computer program instructions executable by the processor, for performing the steps of:

receiving a query including at least a first object and a desired relationship between the first object and a second object;

defining a plurality of tiles in a spatial index in the database;

identifying, for the first object, tiles in the plurality of tiles that do not intersect an object and are within the boundaries of the first object while all of a boundary of the first object lies outside the tiles and by identifying tiles in the plurality of tiles that intersect a boundary of the first object;

identifying, for the second object, tiles in the plurality of tiles that intersect and are within the boundaries of the second object and tiles in the plurality of tiles that intersect a boundary of the second object;

providing the query to a primary filter operable to:

comparing tiles of a the first object with tiles of a the second object to determine whether at least one tile of the first object intersects with at least one tile of the second object; and

determining whether the at least one tile of the second object with which the at least one tile of the first object intersects is a tile that intersects the second object while all of the boundary of the second object lies outside the tile;

if so, providing the first object to the results set of objects that satisfy the desired relationship,

otherwise, providing the first object and the second object to a secondary filter operable to:

compare the second object with the first object; and
if the first object fulfills the positional relationship, including the first object in the result set of objects that satisfy the desired relationship

22. (previously presented) The method of claim 1, further comprising the steps of:

exactly comparing the first object the second object if none of the tiles of the second object that intersect with the at least one tile of the first object is a tile that intersects the second object while all of the boundary of the second object lies outside the tile.

23. (previously presented) The computer program product of claim 20, further comprising the steps of:

exactly comparing a geometry of the first object with the second object if none of the tiles of the second object that intersect with the at least one tile of the first object is a tile that intersects the second object while all of the boundary of the second object lies outside the tile.

24. (previously presented) The system of claim 21, further comprising the steps of:

exactly comparing the first object with the second object if none of the tiles of the second object that intersect with the at least one tile of the first object is a tile that intersects the second object while all of the boundary of the second object lies outside the tile.